Creative Arts Therapies for Babies Born of the Addicted:

Neonatal Abstinence Syndrome, Movement, and Music

An Honors Thesis (HONR 499)

by

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Abstract

This senior honors thesis explores the available research literature and guidelines regarding Neonatal Abstinence Syndrome (NAS). NAS is a collection of withdrawal symptoms exhibited by newborns due to in utero exposure to maternal drug use. The focus of this literature review is newborns with NAS due to prenatal exposure to opioids. For these newborns, Finnegan scores are used to assess severity of symptoms and are often used to determine the type and amount of non-pharmacological or pharmacological treatment. The ultimate aim of non-pharmacological interventions for newborns with NAS is to prevent the need for pharmacological treatment. Because there are minimal documented studies regarding outcomes of non-pharmacological interventions using movement and music, further studies on this topic are recommended. This literature review details manifestations of NAS in pre-term and full-term infants, overviews non-pharmacological and pharmacological interventions, and identifies gaps in the literature.

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Process Analysis Statement

My past four years at Ball State University have been a blended learning process due to my nursing and self-created pre-dance movement therapy majors. These classes included didactic and clinical hours for nursing, psychology and dance technique and performance courses, and multiple independent studies. In addition, I completed the additional coursework required to apply to most medical schools, such as organic chemistry, biochemistry, and physics. As I approached the seemingly daunting task of proposing and producing a senior honors thesis, which would effectively serve as a capstone to my Honors College, nursing, and integrated studies experiences, many ideas surfaced. I could combine my nursing and pre-dance movement therapy coursework either into a creative or research thesis, and each option offered plentiful options. As my ultimate professional goal is to become both a clinician and researcher at a children's hospital in the field of neonatology, informed by the best practices of nursing, medicine, and creative arts therapies, I knew that either a creative or research thesis could be beneficial to my future.

I considered taking on a new project, unrelated to a current endeavor of mine, with the goal of offering adaptive dance classes for children with exceptionalities in the community. This idea reminded me of the work I have done with the campus group called The Prism Project, but would be a solo operation where I could experience being individually responsible for a group of students and their advancement in coordination, behavior, and mood. Another idea was centered on a similar concept but would have required an Institutional Review Board (IRB) approval process, which I have already endured once. Time did not allow for a new IRB proposal and submission, so I kept exploring ideas.

I finally chose to focus my senior honors thesis on an extension of the work I am currently doing through the James S. Ruebel Fellowship for Innovative Experiences, awarded for a period of August 2018 through May 2019 by the Honors College. My fellowship has had a two-fold purpose: to simultaneously document in scientific literature the use of movement and music with infants with Neonatal Abstinence Syndrome (NAS) through a human subjects' research study, and to form community partnerships in Muncie, Indiana, to provide MamaRoo infant swings to graduates of Meridian Health Services' Maternal Treatment Program. A large part of the research portion of my fellowship has of course included performing an initial literature review, gathering a research team, formulating a procedure and protocol for the study, and presenting the proposal under full IRB review. After garnering support from the Women and Children's Service Line, Neonatal Intensive Care Unit manager and providers, the local Hospital's IRB, and subsequent approval from Ball State University's IRB, we began the actual study. Interestingly, I spent a significant amount of time outside of the informed consent and data collection processes educating parents on safe sleep when using the swing.

Because the research study is still in process and is not at a point to make conclusions about specific data, I decided that the most helpful contribution I could make to the scientific literature by way of this senior honors thesis was to expand my literature review for dissemination beyond what has been required by IRB. I planned to carry out independent research on the Ball State University Library databases and use the medical library of a nearby teaching hospital and other relevant resources to find, read, analyze, and compile a literature review regarding treatments and interventions for infants born with Neonatal Abstinence Syndrome. Neonatal Abstinence Syndrome, or NAS, is a set of symptoms resulting from in utero exposure to drug use, whether illegal or legal drug such as opioids prescribed for pain or to help

a mother reduce dependency, or street drugs such as heroine or cocaine. Infants born with NAS exhibit symptoms such as irritability, tremors, diarrhea, excessive crying, temperature instability, and trouble sleeping.

My initial literature review of studies conducted with similar interventions of movement and music yielded no extensive research. There is a gap in knowledge about NAS and the effectiveness of non-pharmacological, movement and music therapy. The project outcome for this Honors Thesis was to concisely summarize to the best of my ability all relevant, available peer-reviewed research about treatment for NAS, specifically non-pharmacological interventions, in a final paper.

My target audiences for this project include both health care professionals and researchers who desire to learn about NAS, non-pharmacological interventions, and the use of these interventions to help relieve symptoms of NAS. I learned from this project how to write in a way that describes these methods and this population so that the general public can learn from and understand the review – as parents of children born with NAS may certainly benefit from the information I hope to share. I expect others, of course, to learn about infants born with NAS, and to take away from reading the thesis how relevant and unfortunately prevalent NAS is in our local Delaware County community as well as nationally. Finally, I believe that non-pharmacological interventions— such as those proposed in my research study using movement and music— can serve as an adjunct therapy for infants already suffering from the effects of drugs.

The ultimate goal of knowledge development about non-pharmacological treatments for infants with NAS was expressed well by the neonatologists and neonatal nurse practitioners of our partnering hospital. When my research team presented to one of their monthly meetings at

the beginning of my study, the neonatologists urged us “to find a way to get newborns with NAS off of morphine as the main treatment for their withdrawal symptoms. If you do, you will a part in transforming the field of neonatal medicine for some of the smallest and sickest members of our community.” It is my goal that through this thesis, I will contribute to the literature available to health care professionals treating these infants and to the general knowledge of nurses caring for them so that one day, instead of treating them with more drugs, movement and music can help ease the symptoms of drug withdrawal in neonates.

Creative Arts Therapies for Babies Born of the Addicted

Neonatal Abstinence Syndrome, or NAS, is a set of withdrawal symptoms resulting from in utero exposure to drug use, legal or illegal. Legal drug use may include medications such as opioids therapeutically prescribed for pain or to help a mother reduce dependency. Illegal drugs include street drugs, such as heroine or cocaine. NAS prevalence has increased in neonatal intensive care units (NICU) within the United States, and accounts for 3% of all admissions to the NICU. Infants born with NAS exhibit symptoms such as irritability, tremors, diarrhea, excessive crying, temperature instability, and trouble sleeping. The clinical picture of an infant with Neonatal Abstinence Syndrome is a common set of symptoms of withdrawal. The symptoms are scored, according to their severity, on the Finnegan scale, which was created for any infant less than 30 days old who was exposed to opioids (Allocco et al., 2016).

This literature review will focus on what should be further explored regarding traditional treatment methods for the NAS infant. It will also provide information on non-pharmacological interventions for the NAS infant. This paper will establish manifestations, both in the pre-term and full-term newborns, and pharmacological and non-pharmacological interventions related to NAS. From this review, gaps in the current literature are identified as a recommendation for the focus of future studies that aim to evaluate interventions for NAS.

Manifestations

The Finnegan Neonatal Abstinence Scoring System includes symptoms, which are broken down into which body system is affected: the central nervous system, the autonomic nervous system, the gastrointestinal system, and the respiratory system (Reddy, Davis, Ren, & Greene, 2017). The Finnegan System is a widely accepted assessment tool used throughout NAS treatment, but multiple modified versions of the scale exist, including shortened versions. It has

been found that the Finnegan scale has low internal consistency. This conclusion about the reliability of the scale identifies that beyond the undesired length of the Finnegan scale, it is not perfect. Ultimately, the literature identifies a need for a new assessment tool to rate symptoms of NAS, but because of the diversity of manifestations, current knowledge and evidence-based judgment should be used above all else in determining treatment for infants with NAS (Westgate & Gomez-Pomar, 2017).

When a neonate is experiencing withdrawal from chronic in-utero opioid exposure, the most commonly seen characteristic is hyperactivity of the central and autonomic nervous systems. In the central nervous system, this hyperactivity is manifested as tremors, irritability, high-pitched crying, increased muscle tone, hyperreflexia, sleep disturbances, and in severe cases, seizures. When infants experiencing NAS present with tremors, they are further categorized as mild, moderate, and severe, and occur either when disturbed or undisturbed. These distinctions are reflected on the Finnegan scale with accordingly increased scores. Similarly, high-pitched crying and disturbances in sleep are scored according to their severity or the duration of time during which they occur. In the autonomic nervous system, symptoms can include sweating, sneezing, yawning, nasal congestion, increased body temperature, and mottling of the skin. Body temperature is also assigned a score on the Finnegan scale according to severity. A healthy, full-term newborn does not normally sneeze, yawn, and sweat, and are therefore considered significant findings in the newborn experiencing NAS (Reddy et al., 2017).

Lastly, the gastrointestinal symptoms noted in infants experiencing withdrawal include loose or watery stools, vomiting, poor feeding, and excessive sucking. Such symptoms can lead to an infant excessively losing weight and exacerbation of his or her irritability. Common respiratory symptoms in an infant with NAS are tachypnea, nasal flaring, and retractions, which

are signs of respiratory distress (Reddy et al., 2017). An infant who is experiencing both poor feedings and increased respiratory rate can increase the risk for aspiration during the feedings, which can lead to pneumonia. This risk for physiological compromise explains why these symptoms can lead to admission to the NICU (Maguire, 2014).

Premature infants often experience different presentations of NAS due to their neurodevelopmental immaturity, which can complicate nurses' ability to appropriately assess their symptoms. Muscle tone, tremors, yawning, and mottling, as well as temperature, can be affected by this neurological immaturity. Premature infants are often placed in a thermoregulated isolette when admitted to the NICU because they are unable to appropriately regulate their temperature. The infants' neurological immaturity and lack of thermoregulation affects the nurses' documentation and manifestation of the infants' hyperthermia (Allocco et al., 2016).

Respiratory distress is a common complication of prematurity and so it is often challenging to differentiate whether it is associated with NAS. Similarly, the gastrointestinal symptoms seen in NAS can be commonly found in healthy preterm infants and are therefore less likely to be seen in the population of preterm infants experiencing NAS. Because of the difficulties noted in discerning symptoms of prematurity and NAS, there is a need for a standardized evaluation system and treatment guidelines for preterm infants experiencing the effects of chronic opioid exposure (Allocco et al., 2016).

Interventions

Finnegan scores are evaluated for infants experiencing NAS from opioid exposure in order to assess symptom severity and to guide necessary medical intervention. The use of replacement opioids, such as morphine, is reserved for infants who experience the most severe symptoms of withdrawal (Casper & Arbour, 2014; Maguire, 2014). Nonpharmacological

interventions are also encouraged by health care providers in order to decrease Finnegan scores and duration of hospital stay; ultimately, the goal of nonpharmacological interventions is to maintain physiological stability and comfort for infants with NAS while eliminating the need for medication (Boucher, 2017; Casper & Arbour, 2014; Edwards & Brown, 2016).

The literature also revealed a five-point intervention framework developed by the National Center on Substance Abuse and Child Welfare and the Administration on Children, Youth, and Families. This framework is proposed to serve as a comprehensive model for interventions to reduce harm among infants with prenatal substance exposure (Substance Abuse, 2016, p. 16). The five points of intervention are pre-pregnancy, prenatal, birth, neonatal, and throughout childhood and adolescence. Although interventions in the first two points would prevent necessity of further use of nonpharmacological treatment, interventions during the neonatal period are the focus of this literature review (Substance Abuse, 2016).

Pharmacological Interventions

The American Academy of Pediatrics (AAP) provides guidelines for medical management of NAS but does not provide recommendations for a defined, standard first dose of medication, nor an evidence-based weaning schedule (Maguire, 2014, p. 204). Opioids such as morphine are often used to soothe and stabilize infants with the most severe Finnegan scores and symptoms. Opioids can be prescribed therapeutically in scheduled doses or spot dosing, otherwise known as PRN (as needed). Buprenorphine, a mixed opioid agonist-antagonist, has also been used to treat infants suffering from NAS, but studies are lacking that support its efficacy (Maguire, 2014). Ultimately, medical intervention is required in order to control the withdrawal process in 27% to 91% of neonates with NAS because of severity of symptoms (Kocherlakota, 2014, p. e554). It can be hypothesized that the wide range of percentages

necessitating medical treatment can be attributed to three factors: (a) variance in Finnegan scoring based on subjective assessment of nursing professionals; (b) the individual practice of each physician; and (c) complex medical issues that each infant faces.

Because the AAP does not provide specific guidelines for dosing medication in neonates experiencing NAS, Finnegan scoring is used to rate severity of a neonate's withdrawal symptoms. This indicates the medical intervention is at a sufficient level determined individually by each physician or hospital policy. According to a clinical report published by the American Academy of Pediatrics, withdrawal score thresholds for initiation of pharmacologic intervention have not been comparatively studied (Hudak, 2012, p. e548). While the assessment tools used to establish adequacy for medical intervention are not codified within the neonatology community, evidence for the most effective treatment method is also limited, and often based on small studies (Wachman, 2018). It is worth noting that delaying pharmacological therapy is associated with longer hospital stays, meaning that withdrawal scores may remain elevated and other serious signs can be observed in neonates who have not had relief from supportive therapy (Kocherlakota, 2014, p. e554). This association of delayed administration of pharmacological therapies and higher morbidity rates for neonates with NAS establishes both a pressing need for research studies centered on setting standard recommendations for first doses of therapeutic narcotics and specific dosing schedules, as well as evidence to support non-pharmacological interventions that can prevent the necessitation of medical intervention.

Non-Pharmacological Interventions

Research has supported the effectiveness of selected nonpharmacological interventions in assisting the newborn experiencing opioid withdrawal to successfully exhibit regulatory behaviors. The most common, initial, non-pharmacological approaches to therapy cited in the

literature and established by the AAP are minimizing environmental stimuli, promoting rest and sleep, and providing sufficient caloric intake for growth and development (Hudak, 2012, p. e554). Some other interventions cited in literature are rooming-in, environmental modification, positioning, and nutritional support (Boucher, 2017; Dulski & Blobaum, 2014; Edwards & Brown, 2016; MacMullen, 2014; Maguire, 2014).

The use of rooming-in is exhibited by an infant remaining in the room with his or her mother and/or father instead of being directly admitted to the NICU during the initial stages of withdrawal. The focus of rooming-in is on the maternal-infant dyad and on promoting bonding in the earliest days of the infant's life through certain behaviors (MacMullen, Dulski, & Blobaum, 2014). This focus on the mother-infant dyad through rooming-in results in lower Finnegan scores, shorter length of stay, and less need for medication (Boucher, 2017; Edwards & Brown, 2016). In addition, if medical treatment is required, the use of rooming-in has proven to decrease the duration of medication replacement therapy and lower the overall amount of medication needed by the infant (Boucher, 2017). These incredible accomplishments of rooming-in speak to the potential for using rooming-in and human connection in the non-pharmacological treatment of NAS in order to hopefully eliminate the need for medication to soothe and stabilize the infant experiencing drug withdrawal.

It is often recommended that infants with NAS be provided with certain environmental accommodations due to their central and autonomic nervous system symptoms because of a lack of ability to self-regulate. The stimuli removed often include bright lighting, loud noise, and anything that could interrupt the sleep state (Maguire, 2014). These common practices can be interpreted as a need for less stimulation, including less interaction with the parents. This is juxtaposed by the practice of rooming-in, which provides for a focus on the parent-infant

attachment relationship. Rooming in is developed in an unfolding exchange between caregiver and infant on a nonverbal level and involves both self-regulatory and co-regulatory processes (Tortora, 2010, p. 37). This relationship, which can be analyzed using the principles of attachment theory proposed by Bowlby, can be described as an interdependent or co-regulatory system (Tortora, 2010, p. 37). When describing the mother-infant relationship in this way, the case for using nonpharmacological interventions to assist the infant in self-regulating is strengthened. The use of rooming-in and other interventions that mirror the ability of the mother to respond to her newborn in a reliable manner may include nonverbal communication such as body movement and sensation (Tortora, 2010). The focus of rooming-in is on the infant's nonverbal experience at its core.[1]

There is minimal literature on music therapy or movement therapy with infants experiencing NAS. However, studies that used music therapy determined that recorded classical music showed increased sleep and decreased crying. A case study using live singing and movement provided connection between the infant's breathing and the rhythmic quality of a live voice. In addition, the intervention helped to reduce the infant's physiological and emotional arousal (Calabro & Grocke, 2017, p. 38).

Other studies resembling these therapeutic music and movement interventions for infants with NAS include stochastic vibrotactile stimulation (SVS), nonoscillating waterbeds, and rocking beds. The results of these studies showed that SVS reduced hyperirritability and pathophysiological instabilities, which are often observed in opioid-exposed neonates (Zuzarte et al., 2017, pp. 12). Infants in nonoscillating waterbeds required less medication to control

[1] For the purpose of the author's interests, the potential nonpharmacological therapies evidenced in the current literature and centered on movement and music are discussed at length in the following pages.

withdrawal signs and demonstrated earlier and more consistent weight gain (Maguire, 2014, pp. 207). Several non-pharmacological interventions were shown to have a positive effect on newborns with NAS (Edwards & Brown, 2016, pp. 305).

Though not published in scientific literature, an article from the Toledo Children's Hospital explained their NICU's search for a product that would provide a soothing method for NAS babies. They elaborated on their use of the MamaRoo automated swing and its positive impacts on NAS infants. The MamaRoo provides vertical rocking instead of the horizontal rocking that most babies prefer and and allows "just the right balance of motion and stimulation to soothe and comfort babies experiencing withdrawal," (Toledo, 2016, pp. 2).

The Cleveland Clinic Children's Hospital is another example of a published lay literature resource found that supports the use of vertical rocking in non-pharmacologic management of infants with NAS. It also explains their hospital policy in using low noise with recorded music/voice and that white noise is also acceptable, if tolerated by the infant (Cleveland, 2016, pp. 7). Cleveland Clinic's NICU unit protocol for the adjustable baby rocker, also known as the MamaRoo mentioned above, is that an MD order is required for use. In addition, clinical staff must assess positioning prior to the first use, the infant must be older than 37 weeks gestation, have an SpO2 monitor, have the seat adjusted to a 45-degree angle. With these constraints, the swing must be set to a low or medium low speed. The infant may use the swing up to 180 minutes per day, but no more than 60 minutes per use, and music therapy along with occupational and physical therapy are encouraged to provide appropriate developmental stimulation (Cleveland, 2016, pp. 13).

Other currently proven therapeutic non-pharmacological interventions for the NAS infant outside the scope of music and movement therapies include breastfeeding, swaddling, rooming-

in with his or her mother, and skin to skin contact (Ryan, Dooley, Finn, & Kelly, 2018) as well as positioning and acupuncture/acupressure (Edwards & Brown, 2016). These interventions have exhibited effective management of the symptoms of NAS and are suggested for incorporation into this population's standard of care. Another review of NAS management associated non-pharmacological interventions with improved outcomes and shorter lengths of stay (Grossman, Seashore, & Holmes, 2017). Therefore, it is necessary to invest in continued research and application of evidence-based practices in the treatment of newborns exposed to opioids in utero. According to Grossman, Seashore, and Holmes, projects focused on such interventions appear to hold the most promise (2017).

Compared to research on non-pharmacological treatments for infants with NAS, non-pharmacological treatments in for pre-term infants during painful procedures have been studied much more in depth. This does not include NICU infants who are not opioid-exposed and therefore not being treated for NAS. These studies do not include NICU infants who are opioid-exposed and therefore are not being treated for NAS. Specifically, using sensorial saturation in pre-term NICU infants and rocking for full-term NICU infants were shown to decrease pain indicators for these populations, and music therapy has been used as a promising soothing technique. Of six different pain-reducing interventions, the lowest pain scores and total duration of crying were found in both the non-nutritive sucking and rocking groups (Mathai, Natrajan, & Rajalakshmi, 2006, pp. 1070).

Similar to this discovery with rocking, another study explored the use of sensorial saturation (SS), which is the use of gentle, non-painful stimuli during a painful procedure. The mechanism of SS is based on the competition of stimuli and the sensation of pain when being transmitted to the central nervous system (Gitto, et al., 2011, pp. 928). SS has been well studied

and includes multiple sensory levels including tactile, auditory, olfactory, and orogustatory. SS was also found to be effective as an analgesic intervention when performed by mothers and experienced nurses (Gitto, et al., 2011, pp. 931).

An older article by Ulrich (1984) summarized the numerous studies on various treatments aimed at compensating for the last weeks in the womb of which pre-term and low birth weight infants are deprived. He examined a study regarding high-risk infants and the impact of stimulation on their development. Ulrich's ultimate conclusion was that, by providing more natural nurturing such as the rocking, tactile, and auditory patterns of the womb, the high-risk infant might have a better start to life (Ulrich, 1984, pp. 76). These goals of mirroring the prenatal environment can be achieved through the use of movement and music therapies and maternal interaction with the infant.

Lastly, the similarities between lullabies, white noise, fluid sounds of the womb, and the intrauterine heartbeat explain why a mother's singing can significantly improve the heart rate and feeding behaviors of full-term and pre-term infants in the NICU environment (Maguire, 2014, pp. 206). Maguire (2014) also explained that soft singing and white noise may be useful and therapeutic for NAS infants, but there is not yet sufficient evidence to support it as an intervention (p. 206). These findings were not explored in NAS infants, but they have great implications for adaptation for this population and are valuable to consider in this review of the literature.

Synthesis

There is an evident gap in the literature to support the use of movement and music therapies in NAS infants. This is predominantly due to the lack of studies completed. The scientific literature reveals a few successful interventions related to movement, but even fewer

music interventions studied in this population, though the lay literature shows at least two institutions using movement and music interventions as a part of their published NICU policies for NAS infants.

MamaRoo swings are in use in over 300 hospitals nationwide, according to the 4moms website. A few key findings from this review that may apply in any future studies are that expert opinion strongly defends minimizing external stimuli and creating a soothing environment for the NAS population. Though this is widely accepted as best practice for NAS infants, it appears that institutions each have their own interpretation of what this means and what the boundaries are for these considerations. As concluded in the vibrating bed intervention by Zuzarte et al. (2017), the therapeutic potential for movement and music interventions "requires further study in larger sample sizes to define optimal regimens and determine safety and efficacy" (p. 12). Hundreds of hospitals effectively use nonpharmacological methods in management of the NAS infant, and therefore evidence its efficacy and ease of implementation, meaning that nonpharmacological treatment should universally be incorporated into the standard of care for the infant with NAS (Ryan et al., 2017).

Conclusions

A review of the current literature regarding non-pharmacological treatment methods in opioid-exposed or Neonatal Abstinence Syndrome (NAS) newborns revealed little knowledge on the use of movement and music therapies as supplemental interventions for withdrawal symptoms in these neonates. In addition, the literature supports that there is a gap in the availability of evidenced-based and documented explorations of this topic.

One might wonder why the prevalence of Neonatal Abstinence Syndrome continues to rise despite increased community awareness of the issue of prenatal maternal use of opioids,

especially in the presence of appropriate prenatal care. For pregnant women who are receiving adequate prenatal care and have been identified as abusing opioid drugs, medically assisted treatment is used in order to both keep the fetus safe and help the mother discontinue the use of the illegal or non-prescribed substance. It is preferred to use medically assisted "treatment using agonist medications rather than withdrawal management or abstinence as these approaches may pose a risk to the fetus" (Substance Abuse, 2016, p. 10). Treatment with methadone or buprenorphine, as well as substance abuse counseling and social support, eliminates the risk of the fetus going through withdrawal in the womb, as discontinuation of opioids in an abrupt manner can result in preterm labor or fetal distress and demise (Substance Abuse, 2016, p. 9). For these reasons, the urgency of establishing an evidenced-based medication regimen for treatment of these infants born to mothers who are addicted to opioids is imperative.

Gaps in the literature exist in many areas of this topic, from pharmacological to nonpharmacological treatment. Interventions in the pharmacological realm need to be researched further, including the best opioid replacement to use for the mother during the prenatal period if medically assisted treatment is used. The decision on the exact treatment for the mother during this time has a direct reflection on the neonate's withdrawal period.

The opportunity for low-risk research studies and interventions featuring movement, music, and similar nonpharmacological approaches based on the principles of creative arts therapies hold extreme promise, as evidenced above. As the general public becomes more aware of our country's smallest victims of the opioid crisis and the withdrawal symptoms they endure, and if nursing research becomes further empowered to explore this topic as a priority area, this gap in the literature can hopefully be filled with evidence-based, widely used interventions including movement and music.

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